EXTRALUM

Technical Bulletin

Anodized aluminum

EAnodizing is an electrolytic process by which a protective layer is formed on the surface of the base aluminum known as "alumina" or aluminum oxide (Al2O3). This layer is formed due to the passage of an electric current in an acidic electrolyte, taking aluminum as the anode. According to the thickness of this layer (see Figure 1), greater resistance and durability to external agents (water, saline environments, UV rays, etc.) are obtained.

This result, added to the aesthetic finish that is achieved with anodizing, opens up infinite application possibilities for commercial and industrial products and components.

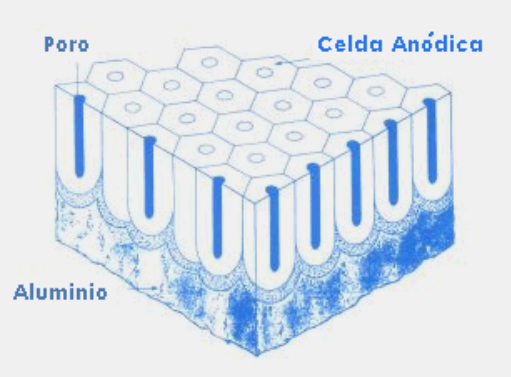


Figure 1. Typical anodic layer scheme

1. Properties

Anodized aluminum is one of the metals with the highest attributes in terms of strength, resistance, stability and insulating capacity. Most metals suffer "corrosion" when exposed to the environment, which can have different degrees of severity, but regardless of them, the metal surface is transformed by changing its appearance and especially its mechanical properties.

Durability: Anodized aluminum is one of the metals with the highest attributes in terms of strength, resistance, stability and insulating capacity. Most metals suffer "corrosion" when exposed to the

environment, which can have different degrees of severity, but regardless of them, the metal surface is transformed by changing its appearance and especially its mechanical properties.

Despite their superior strength, both anodized surfaces and other building components must be protected from chemical attack after installation.

Low Maintenance Costs: In most cases, a simple cleaning with mild soap and water will restore the original appearance of the anodized aluminum surface. Although anodized aluminum requires less maintenance than other finished metals, it is essential to establish that cleaning routines should be performed at a frequency appropriate to the conditions of the installation site environment. Industrial areas with a high concentration of carbon dioxide (CO2) require, for example, a higher cleaning frequency than rural areas in less polluted environments.

Aesthetics: Anodizing offers a wide variety of tones, colors and shiny or matte textures, satisfying the most demanding and varied tastes. Unlike other finishes, anodized aluminum allows to maintain the metallic appearance of the material. The anodic layer is translucent, this allows the base metal to be observed, giving aluminum a metallic surface appearance far superior to that which can be achieved with organic paints.

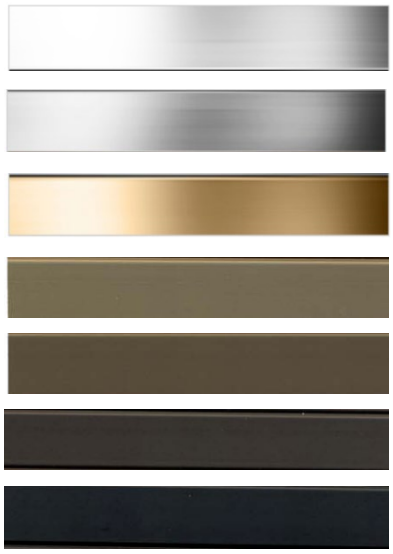
Safety: An anodized finish is chemically stable. It does not decompose; it is not toxic. It is not combustible below the degree of fusion of aluminum: 660° C., providing a very high degree of safety.

Recyclable: The anodizing process does not alter the recyclable properties of aluminum

Electrical insulator: It has insulating qualities with a breakdown voltage of 500 - 600 V in a thickness of 12 -15 microns.

2. Design and Quality Considerations

Availability of Colors. Architectural finishes for anodized aluminum are limited to certain colors, including champagne, black, and traditional bronze tones.



Clear Anodized

Anodized Inox

Champagne

Clear Bronze

Medium Bronze

Dark Bronze

Black Anodized

Perfect color reproduction

Color perception is a condition that depends on many factors; from properties of the object (such as texture and size) and the light source, through contrast and angle of view, to even characteristics of the observer or receiver (such as age and sex). In summary, color in a finish is a very subjective condition, if you think that each person perceives colors differently.

Color in the anodizing process is generated by two basic techniques: by absorption and by electrodeposition.

Organic dyes are used in the absorption technique. The process is similar to dyeing a T-shirt: the material is immersed in a tank of the desired color and after a certain time it is removed. The color is then absorbed into the pores of the anode layer. With this technique, in general, the color can be reproduced better, but it has the problem that organic dyes are easily discolored by the action of the sun. Its durability is very low.

Electrolytic staining or electrodeposition is the technique that gives profiles for architectural use greater durability and light fastness. It is used by Extralum S.A. Its principle is to use an electrical energy source

(transformer-rectifier) that generates a metallic deposit within the layer of the anodized material or anodic layer.

Many factors influence the color appearance of anodized architectural aluminum: the alloy, the extrusion temperature and speed, the quenching, the texture of the aluminum surface (longitudinal roughness versus transverse roughness), the parameters of the anodizing process (temperatures , voltages, current density, time, pH), the thickness of the anodic layer. These factors, added to those previously exposed, such as the angle of observation, lighting and observer conditions, make it impossible in practice to achieve perfect color reproduction.

In most cases, anodized profiles exhibit an excellent consistency in color, without this meaning a perfect reproduction of it.

The industry establishes visual comparisons as a criterion for color matching. If a component is significantly different from an approved standard, the finish will not be accepted as compliant. The number of variables involved in the anodizing process necessitates the use of a sample range that establishes the "light-dark" limits for a given finish, providing a visual reference to represent the appearance extremes that can be expected in the parts with finish. As an example, Figures 2 y 3, are observed, for the finishes "champagne" and "dark bronze" respectively:

Ligth Limit Dark Limit

Figure 2. Sample range of champagne finish.

Light Limit Dark Limit

Figure 3. Sample range dark bronze finish.

The parts used as "**Pattern Range**" (this is the name of the extreme pair of limits, light and dark, for the same finish) are not always of the same alloy, temper and shape as those used in a particular project but, even so, they are designed as a visual aid to the degree of possible color variation.

Extralum S.A. applies strict quality controls on raw materials, manufacturing processes and the final product. These controls include visual compliance inspections and internal and external laboratory tests that include verification of seal quality, anodic layer thickness, and other criteria. However, and due to the number of variables that influence the final finish Extralum S.A. cannot guarantee uniformity of tone in anodized aluminum profiles.

Touch-ups on the surface. The anodized finish is applied during a controlled electrochemical process, which is why, when it is necessary to repair or touch up the surface, it must be done with paint. A paint finish will never match the anodized finish.

Visual imperfections on the surface. Anodizing is an integral part of aluminum and does not hide some inherent extrusion characteristics such as lines and stripes on the surface.

Applications of anodized aluminum

- Architectural structures: curtain walls, roof systems, windows, awnings, doors, window frames, bathroom accessories, etc.
- House appliances.
- Exteriors and interiors of buildings.
- Sport items: Golf carts, camping and fishing items.
- Nautical.
- Parts for electric motors.
- Furniture.
- Automotive and aeronautical industry.
- Aerospace industry: protection and signaling of satellites due to resistance to UV rays

Care of anodized aluminum in the installation

Cleaning procedures should begin as soon as possible after installation to remove construction and environmental deposits such as dust, concrete, putties, etc.

The simplest way to remove light deposits is to wash the surface with water under moderate pressure. Then the surface must be completely air dried. In document IT-008 "Cleaning Aluminum Profiles", you will find more recommendations on the appropriate way to clean and remove heavy deposits.

If you have any doubts, consult the Sales Department of Extralum, S.A.